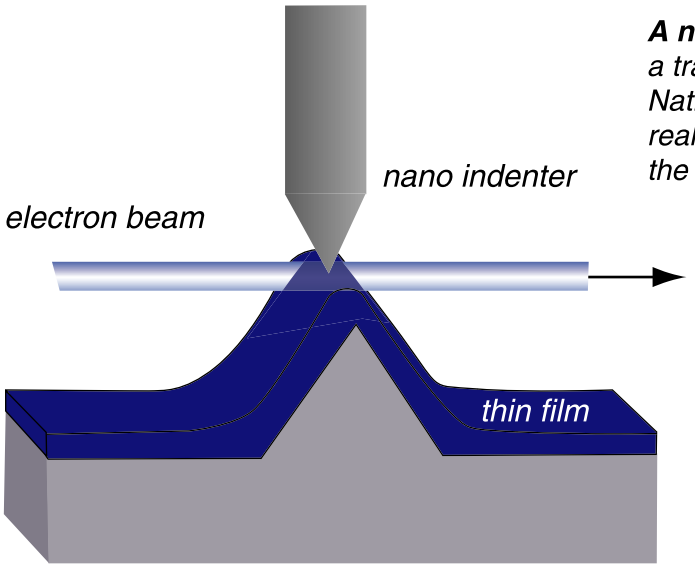
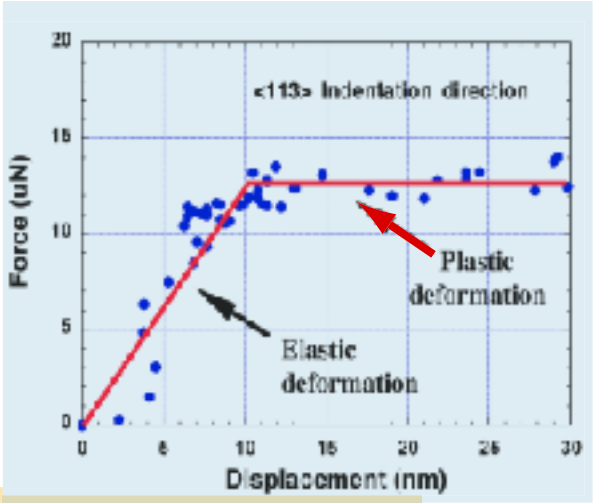
Real-Time, Nanoscale Failure Analysis Achieved

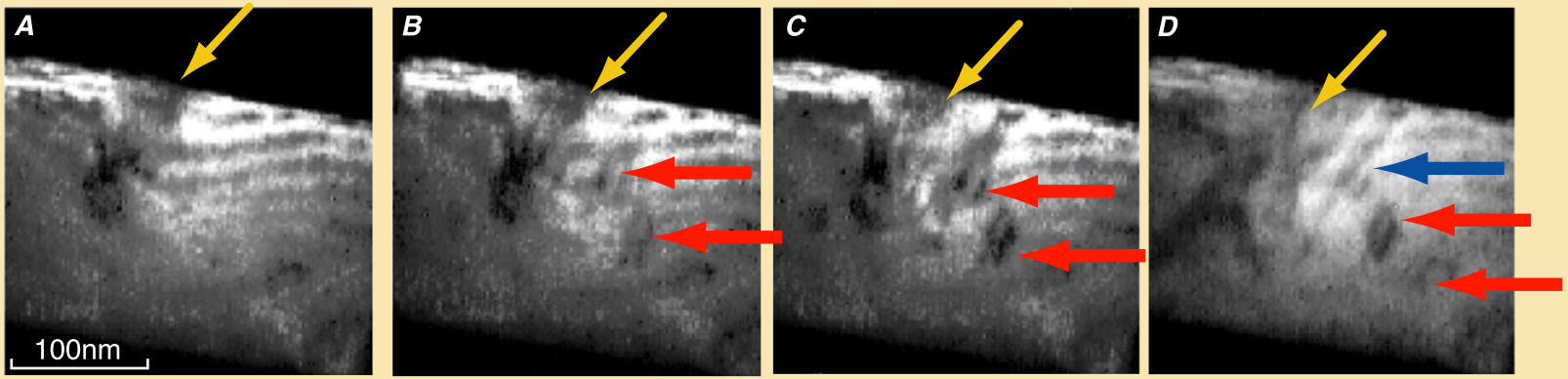
Experimental Technique Allows New Insights into Material Deformation



A new nanoindenter *has been constructed inside a transmission electron microscope at LBNL's National Center for Electron Microscopy. It allows real-time atomic-scale images to be obtained from the sample during the indentation test.*



In-situ **observation of deformation**



In the elastic segment of the load-displacement curve (upper right), images such as (A) are observed. The yellow arrow marks the location of the indenter which is not seen in these dark field images. In image (B), taken at the onset of plastic deformation, two new dislocation loops (red arrows) are introduced into the material. These move deeper into the sample (C) as the displacement of the indenter is increased. Formation of another dislocation (blue arrow) can be seen as the indenter is pushed further into the sample (D).

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